

## Civil engineering novel patents

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**Abstract:** The article describe a lot of novel patents in Civil Engineering, more of them from China

**Keywords:** patent's description, civil Engineering.

Early I gave the review of last researches on Civil Engineering (see [1]). According the search at Espacenet – patent' search we have more than 1500 such patents – the last of them see below.

US8,615,967B1 - The technology of building reinforced concrete structures using the combined method of precast concrete (by O. Figovsky, A. Futoriatsky [2,3]).

This technology allows construction to be build much faster and with less manpower than with the traditional method, while maintaining the strength of the structure.

The main point of the method:

- Precast elements (internal and external walls) will be used as molds for pouring concrete columns at the construction site.
- The floor casting will also be based on lightweight prefabricated elements integrated with the walls.

THE LIGHT HOLLOW WALL ELEMENTS AND METHOD OF ERECTING OF BUILDING'S WALLS WITH THE USE OF SUCH ELEMENTS (by O. Pigovsky, D. Abramov) [4].

The method of erecting the walls of buildings using light hollow wall elements includes: installation of rigid reinforcing cage of the buildings columns, setting of the light hollow wall elements in the erected wall and setting of the additional reinforcing rebar in the columns and walls required according to calculation, filling with concrete of the hollow space, placement of concrete in the reinforced concrete floor slab over the erected storey simultaneously filling with concrete the part of the hollow space in the wall above the window level.

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US2023399836 (A1) - METHODS, SYSTEMS, AND COMPONENTS FOR MODULAR CONSTRUCTION OF MULTI-STOREY BUILDINGS [5].

A modular system of interconnected modular blocks having columns with male and female ends, structural space frames comprising horizontal structural sections arranged in a rectangle with a connector at each corner. The structural space frames and columns are collapsed into a modular sandwich for transportation where male ends of connectors connect with respective female ends of connectors between structural steel space frames and when the modular block is erected from the sandwich, a male connector of a lower structural space frame couples with a female end of a column of and a female connector of a top structural space frame connects with a male end of a column. The modular system is transported in collapsed form to a building site and is erected into a building structure by lifting a higher space frame, erecting the columns to create a modular unit and repeating to create stack of modular units of desired building height.

AU2022286399 (A1) - SYSTEMS FOR RAPID ACCURATE COMPLETE DETAILING AND COST ESTIMATION FOR BUILDING CONSTRUCTION FROM 2D PLANS [6].

A structural building design system for processing, interpreting and analysing holistically a multipage set of two-dimensional (2D) real-world building construction plans for a building and yielding near real time accurate material type, quantity, and specification outputs as required for construction of a compliant building from said plans, through computationally generating a mathematical feature vector space dataset, the system comprising: one or more processors configured to: receive a two-dimensional real-world architectural plan for construction of a structural building, wherein the two-dimensional real-world architectural plan includes objects comprising: architectural symbols, lines, shading, or text; perform pre-processing, of characteristics on or associated with

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the objects on the two dimensional real-world architectural plan on a pixel by pixel basis for measurement or adjacent multi-pixel basis for object detection, wherein the pre-processing comprises two or more of: object detection and recognition, semantic segmentation, or text recognition to identify a plurality of objects, on the two dimensional real-world architectural plan to identify the characteristic features thereof.

TW202336325 (A) - Formwork engineering construction method for houses with door and window frame assembly and integrated cast concrete solid sealed door and window frame capable of forming a high-quality, high-value-added structural product (house) with one-time construction waterproofing effect [7].

A "formwork engineering construction method for a house with door and window frame assembly and integrated cast concrete solid sealed door and window frame" relates to the creation of formwork engineering in civil or construction engineering. At a location where a window or a door frame needs to be installed on a building structure, a positioning plate (which also serves as a side formwork plate for the window frame or door frame) is used to assemble the window frame or door frame, the inner and outer side formwork plates (or materials, pads or fastening plates) of the window frame or door frame, and internal support materials, so as to form a "window frame or door frame assembly" with a thickness equal to or slightly smaller than the spacing of the wall formwork cavity. Moreover, by directly using iron nails, the positioning plate assembled on the "window frame or door frame assembly" is fixed to a side formwork where a wall formwork cavity of the structure formwork construction is first assembled. By further tying steel bars and distributing water and electricity pipes, the other side formwork is assembled, and the two side formworks of the formwork cavity is fixed on the inner and outer sides of the "window frame or door frame assembly". The present invention has inventiveness or novelty, and industrial applicability in forming a wall formwork cavity of a composite material structure

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and recycles formwork materials to reproduce the "window frame or door frame assembly", which is a formwork engineering construction method with great industrial practicability and circular economic value. In the present invention, the "window frame assembly" or "door frame assembly" is directly produced; or the "door frame or window frame assembly" of the house is directly installed in the wall formwork cavity of the formwork construction, and the concrete is then poured to produce a "solid sealed window frame or door frame on the concrete of the wall structure", thereby forming a high-quality, high-value-added structural product (house) with one-time construction.

US2023383534 (A1) - MODULAR CONCRETE BUILDING BLOCK AND METHODS [8].

A concrete block includes first, second, third, fourth, fifth, and sixth planar faces. The first and second faces are generally parallel, and the distance between the first and second faces define a thickness of the first block; the third and fourth faces are parallel to each other and perpendicular to the first and second faces; the fifth face is perpendicular to the first, second, third, and fourth faces; the sixth face: extends perpendicular to the third face; extends toward the fourth face and ends at a non-planar remainder section; is parallel to the fifth face; is contained in a plane that intersects a plane containing the third face; and a distance from the intersection to the remainder section is at as least as long as the thickness of the first block; and the remainder section extends between the sixth face and the fourth face and has a shape such that when a second block of the same construction as the first block has its remainder section engaged against the remainder section of first block, the remainder sections of the first and second blocks mate.

WO2023225689 (A2) - METHODS AND APPARATUSES FOR CONSTRUCTING HIGH-RISE BUILDINGS [9].

Embodiments are directed to a lock for securing a structural assembly having a primary beam for constructing a core-supported high-rise building, and a building

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core wall defining an outer face. The lock includes a fixed bracket that couples to the primary beam of the structural assembly, a structural pin, a moveable component connected to the fixed bracket by the structural pin, and a recessed pocket embedded in the building core wall. The moveable component defines a bearing surface that contacts the outer face of the building core wall during the raising of the structural assembly. The recessed pocket receives the moveable component of the locking device when the structural assembly reaches one of the predetermined positions. The moveable component automatically engages with and disengages from the recessed pocket as the structural assembly rises, enabling temporary support and securement of the structural assembly at the predetermined positions during construction.

US2023383533 (A1) - INTERLOCKING CONSTRUCTION BLOCKS [10].

The present invention is an improvement on a previous version of an interlocking building block system for use in constructing a building wall. The improvements introduced are radii corners and chamfered edges that allow for claddings to be attached to the wall by leaving space for mechanical screws to be secured between two blocks. Furthermore, the radii corners allowed for increased mechanical movement between two interlocking blocks, resulting in greater durability of the blocks. The improvement also include a corner block and an intersecting block which replace the need for using multiple blocks to create intersecting points or corners. Some blocks also contain an additional hollow cavity with channels to allow increased support members to be introduced between blocks, thus increasing the height of the walls that can be built using the block system.

US2023392376 (A1) - MODULAR BUILDING CONSTRUCTION [11].

A building panel is constructed of a corrugated material. The panel can be folded into a U-shaped configuration. Successive folded panels can be coupled together using complementary shaped corrugations to fix panels in position relative to each

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other. Shaped connectors can be used to connect building panels in one plane to building panels in another plane.

AU2022277759 (A1) - HYBRID BUILDING SYSTEM, BUILDING AND METHOD [12].

Hybrid buildings, hybrid building systems and methods of constructing hybrid buildings are disclosed. First and second building sections forming part of such buildings are also disclosed. One such hybrid residential building (1600) comprises a first building section (1610) and a second building section (1620). The first building section is an on-site construction at a final location for the building and comprises a lower storey (1611) defining an internal volume (1613) that provides a lower living space (1615) within the building, and an upper storey (1617) defining an internal volume (1619) that provides an upper living space (1621) within the building. The second building section defines an internal volume (1623) and is transportable to the final location in a substantially assembled form. The first and second building sections are connected at the final location to form the building. The second building section defines a circulation space (1649) for the building, access between the upper and lower living spaces of the first building section being provided via the circulation space.

WO2023240108 (A1) - IN SITU CONCRETE BUILDING CONSTRUCTION USING ADDITIVE MANUFACTURING [13].

The present invention provides an efficient means and method for on-site rapid construction of a cement building, such as a home or the like. At least a pair of frames are placed at the site, each equipped with auto leveling devices and transport wheels. The frames are delivered by a rig to the construction site and detached therefrom. An extruder mounted on a guiderail in communication with a source of cement travels along an axis to deposit cement at predetermined locations. Suitable controllers connected to a motor move the extruder in the X, Y

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and Z directions in predetermined pathways. A Counterbalance connected to the guiderail maintains the guiderail of each frame horizontally.

WO2023235916 (A1) - DEMOUNTABLE CONSTRUCTION AND COMPONENT THEREFOR [14].

A connection member (60, 60') for connecting two elongate frame members (93,120, 122, 126, 128) of a demountable frame building (168) has an attachment portion (62, 62') for attachment to one frame member (120, 122, 126, 128) and a receiving portion (64, 64') for sliding engagement with a hollow end of a second frame member (93). The attachment portion and receiving portion are integrally formed from a single piece of material. The receiving portion has a rectangular cross-section smaller than and offset relative to the rectangular cross-section of the attachment portion to define a shoulder (66, 66') around the receiving portion on the attachment portion of greater depth (68, 68', 72, 72') on at least one side (70, 70', 74, 74') of the receiving portion. The receiving portion has a screw-threaded passage (86, 86') for a locking member (150) to secure the receiving portion in the second frame member, the passage opening for receipt of the locking member on an opposite side (88, 88', 90, 90') of the receiving portion. One embodiment (60') has a shim (108) for guiding the sliding engagement.

US2023407625 (A1) - MODULAR CONSTRUCTION CONNECTION MECHANISM [15].

A system for securing modular building units to each other and a method for assembling structures using said method is disclosed. The disclosed system allows for modules to be connected to each other from an external position, without a person having to enter the modules to fasten components internally. The system and method may be used to build structures using prefabricated modules, avoiding



significant amounts of onsite labor and drastically reducing the time required to erect structures.

US2014000182 - A construction element for erecting a structure has a first panel extending vertically to form a wall and a second panel extending horizontally to form a horizontal partition when they are arranged in an erected structure, the panels together form a three-dimensional configuration and are connected with one another so that in the erected structure they extend perpendicularly to one another and are turnable to include an angle there between to reduce a horizontal extension of the construction element for transportation purposes.

JPH0828458 - To improve the efficiency of excavation operation SOLUTION: The first segment 4 of a hole or a tunnel is excavated, and the section is formed so that the first segment walls assume a final shape and size corresponding to the external shape and size of the support walls. A leading support wall element 16 is inserted into the segment 4, the further segment 4 of the hole is excavated, and the segment is formed so that its walls assume a final shape and size corresponding to the external shape and size of the support walls. The first support wall element is moved into a further segment and the succeeding support wall element is introduced into the first segment, and necessary steps are repeated until constructing the entire hole.

WO2023235437 - Techniques for and examples of wall structures formed of extrudable building material (i.e., extrudable material) include a first shell having a first group of stacked elongated beads of extruded material that forms a first wythe, the first shell forming a first surface of the load-bearing wall structure, a second shell spaced apart from the first shell, the second shell having a second group of stacked elongated beads of extruded material that forms at least two

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second wythes, the at least two second wythes forming a second surface of the load-bearing wall structure, and at least one structural support that has a first portion embedded in the first shell and a second portion embedded in the second shell.

US2023394052 - A building management system (BMS) by including building equipment configured to provide raw data samples of one or more data points in the BMS. The BMS further includes a data collector configured to collect raw data samples from the building equipment and generate one or more raw data timeseries comprising a plurality of the raw data samples. The BMS also includes a timeseries processing engine. The timeseries processing engine is configured to identify one or more timeseries processing workflows that apply to the raw data timeseries, each of the workflows comprising a predefined sequence of timeseries processing operation. The timeseries processing engine is further configured to process the raw data timeseries using the identified timeseries processing workflows to generate one or more derived data timeseries. The BMS further includes a timeseries storage interface configured to store the raw data timeseries and the derived data timeseries in a timeseries database.

TW202331069 - A formwork engineering construction method, for a floor plate mold and a wall side mold is disclosed. The invention relates to the technology of civil engineering, mechanical engineering and material mechanics, and is used in the creation of a liner for a combined side by the floor plate mold (FW-FL) or the wall side mold (cavity) referring to the formwork engineering for civil or construction engineering (FW). In the invention, concrete is cast in a mold cavity to support a uniform load (W) to form an end point (O) of an outstretched side (FW-FL-2-L1) of a first layer of grid (FW-FL-2) and constitute a "fixed side" or "inner support style of simply-supported outer (inner) beam support ", then a

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larger acting force or supporting reaction force is produced on an unit formwork back support or the first layer of grid's outstretched end (O) in the "simple support or three supports or multi-continuous support outstretched beam support type", and a small deflection ( $[\Delta] O-O'$ ) is produced on an outstretched support spacing (K') of a combined side liner (FW-FL-1-K') of the floor plate mold or wall side mold; or a support reaction force close to zero is produced at the outstretched support point of the combined side liner (FW-FL-1-K) of the floor plate mold or wall side mold; a larger force (energy) is produced at the outstretched end (O) of the first layer of grid of the floor plate mold, so as to achieve progressiveness or novelty and industrial utilization for controlling (inhibiting) or feedbacking the deflection or negative deflection of the support point of the first layer of grid; or a formwork engineering construction method is directly produced (exported) based on deflection curve equation between the outstretched end (point) or the support point of the first layer of grid (or unit formwork back support) of the floor plate mold or wall side mold (cavity); the floor plate mold or wall side mold (cavity) of the formwork engineering is produced; structural products are produced through the cast concrete in the floor plate mold or the wall side mold to reduce the deflection (added values of increased flatness, reduced materials, etc.); those are extremely valuable in industry.

CN116911002 - The invention discloses an assembled machine room virtual pre-assembling method based on BIM and a point cloud technology. The method comprises the steps of machine room civil engineering and equipment, pipe fitting three-dimensional scanning, point cloud data processing and reverse modeling of point cloud data; a BIM model is generated for comprehensive optimization of the machine room pipeline, prefabricated segmentation of the machine room pipeline is carried out, a processing drawing and a material list are exported, mark points are pasted on prefabricated parts, and three-dimensional scanning is carried out; processing point cloud data of the prefabricated part; superposing, comparing and

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analyzing the prefabricated part point cloud model and the BIM model; superposing, comparing and analyzing the point cloud model of the virtually assembled machine room pipeline and the BIM model, and processing the adjustable section pipeline according to an analysis result; and on-site assembly and construction are guided. According to the method, machine room pipeline optimization, prefabricated part quality inspection and comparative analysis of virtual pre-assembly and the BIM model are carried out according to the actual situation, it can be guaranteed that a machine room pipeline comprehensive result meets the actual site situation, the problem of reworking on the installation site is reduced, and the installation efficiency of the assembly type machine room is improved.

CN116882014 -The invention relates to an automatic building design method based on a BIM (Building Information Modeling) technology. The automatic building design method comprises the following steps: importing a building scheme diagram and early-stage building conditions; pre-parameters are initialized, a project model three-dimensional coordinate system is generated and stored, and the pre-parameters and civil engineering professional design requirements are filled in; generating a BIM model of the civil engineering major; inputting design requirements of the electromechanical system; the cloud calls the preposed parameters, the design requirements and the generated building and structure professional BIM model, and electromechanical system modeling is carried out; outputting the electromechanical system BIM model; the preposed parameters comprise a project site, a project property and a load level; the design requirements comprise specific text description, such as a trunk type power distribution practice and a radial type power distribution practice in a power distribution system. According to the automatic building design method, the labor cost can be reduced to a great extent, drawing reworking is reduced, the design period is shortened, and the drawing quality is improved. The BIM model, the

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CAD drawing and the material list can be generated at the same time, so that the effect of taking the place to start the work can be achieved.

CN116791651 - The invention relates to the technical field of open caissons, and discloses an open caisson structure and an open caisson sinking method. According to the open caisson structure, through the synergistic effect of a functional layer, metal blade feet and a space attitude control system of an open caisson body, the dead weight and the wall thickness of the open caisson can be correspondingly reduced; the well wall of the open caisson body can directly serve as a basement outer wall, the frame structure serves as a supporting system of a basement main body structure, the well wall of the open caisson body and the frame structure are manufactured on the ground and formed through one-time casting, the open caisson is light in size, and the sinking posture is more stable and controllable; supporting piles and jacks configured for sinking construction can be miniaturized, the arrangement density of supporting blocks is more reasonable and optimized, the open caisson technology only used for industrial underground structure construction for hundreds of years is directly introduced into civil building underground structure engineering construction, a traditional foundation pit supporting construction technology is replaced, and the construction efficiency is improved. Waste of a large number of resources such as building materials of temporary supporting structures is avoided, and energy conservation and emission reduction in the building industry are achieved.

CN116695868 - The invention relates to the technical field of space special-shaped steel structure construction, and discloses a vertical face staggered spiral building adopting a pipe truss structure and a construction method. The steel-encased structure of the building is composed of four truss single bodies which are spirally arranged in a staggered mode, each truss single body is composed of a vertical face truss and a roof truss, each vertical face truss is composed of a truss column, a waist truss, a window truss and a shoulder truss, and the ending

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intersections of the window trusses of every two adjacent truss single bodies are connected in a staggered mode through the shoulder trusses. Each window truss is mounted on the civil engineering structure platform by connecting a waist truss with a truss column; the outer side of the roof truss is connected with the window truss, and the inner side of the roof truss is connected to a concrete beam column bracket of the main body structure. According to the method, the BIM technology is applied to establish the model to perform analogue simulation checking calculation on the construction method, the supporting structure, the assembling jig frame and the hoisting equipment, data supporting verification is provided for feasibility of the construction method, and a new thought and method are provided for design and construction of buildings with similar special-shaped space structures.

CN116607398 - The invention discloses a fabricated steel-concrete composite beam and a construction technology, and belongs to the technical field of civil engineering. The fabricated steel-concrete composite beam comprises a plurality of bridge units which are assembled to form a bridge, each bridge unit comprises a steel beam and a concrete panel, the steel beam comprises a first steel plate, a second steel plate and a transverse steel beam, the first steel plate and the second steel plate are vertically arranged in parallel, and the first steel plate and the second steel plate are fixedly connected through the transverse steel beam; the concrete panel is fixed to the tops of the first steel plate and the second steel plate, and comb tooth structures are arranged on the tops of the first steel plate and the second steel plate and located in the concrete panel. The steel beam part and the concrete bridge deck part of the fabricated steel-concrete composite beam MVFT beam are all prefabricated in a factory, secondary concrete slab pouring is not needed, and the construction period is greatly shortened. The manufacturing process of the MVFT composite beam bridge is simple, the self weight is light,

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and the fatigue performance of the MVFT composite beam bridge is better through the comb tooth structure and the variable cross-section design.

CN116533091 - The invention relates to the field of civil engineering, in particular to scaffold board machining equipment and technology for civil engineering construction, and the scaffold board machining equipment comprises a rack, a walking device and a polishing device; the walking device comprises a mounting frame, a fixing plate and a linear driving assembly. A supporting rod is mounted on the mounting frame, rollers are rotatably mounted at the bottom of the supporting rod, a bracket is mounted at the top of the mounting frame, the bracket is arranged on the fixing plate in a crossing manner and is in sliding fit with the fixing plate, a sliding rail is arranged on the bracket, a sleeve is slidably mounted on the sliding rail, and the linear driving assembly is mounted on the fixing plate and is used for driving the sleeve to slide along the fixing plate; and the polishing device is mounted on the mounting frame. Through the rack, the walking device and the grinding device, the function of adapting to scaffold boards with different bending degrees is achieved, the effect that the scaffold boards are not affected by the flatness of the scaffold boards during grinding is achieved, and the problem that traditional scaffold board machining equipment cannot smoothly grind the scaffold boards when the flatness of the scaffold boards is poor is solved.

CN116512695 - The invention relates to the technical field of civil engineering materials, in particular to a self-reinforced regenerated reinforced concrete composite structure and preparation and application thereof. The self-reinforced regenerated reinforced concrete composite structure comprises a regenerated reinforced concrete body and carbon fiber reinforced cement mortar, the carbon fiber reinforced cement mortar is located on the upper surface of the regenerated reinforced concrete body, a plurality of steel bars are arranged in the regenerated reinforced concrete body in parallel, and a main positive plate is pre-buried in the carbon fiber reinforced cement mortar; electrodes are laid on the end portions of

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the two sides in the length direction of the steel bar. According to the invention, the carbon fiber reinforced cement mortar is uniformly paved on the surface of the recycled reinforced concrete main body by adopting a layer paving method design process, so that the preparation cost is greatly reduced, and the intelligentization of the recycled concrete structure is realized. Therefore, the implementation of the technology not only is beneficial to efficient application of the recycled concrete in the aspect of structural hierarchy, but also has important significance in preventing over-exploitation of resources and protecting the environment to the maximum extent.

US2023233834 - Shape memory alloys are used in aerospace structures, orthodontics, cardiovascular prosthetic devices, sensors and controllers, and many other engineering, technology, science, and other fields. The methods are described in the case of a temporary heart assist pump to illustrate the concepts, but the method applies to many other fields. The properties of shape memory alloys are used to fold or collapse and implant in the human body a device without breaking the device as it reaches body temperature or without reaching permanent plastic deformation. The properties of nitinol are also used to describe intended explantation of the device, at body temperature, from the body without breaking it. Such planned explantation may be needed in cases where the device is designed for temporary use, such as mechanical circulatory support devices intended for temporary use and then removal of all components of the device from the body. The same method, according to the patent US2023233834 can be used for devices that have not been initially designed for removal, such as stents or valves, that must later be explanted for reasons unanticipated when they were installed. The methods ensure that the devices stay within stress-strain-temperature conditions so they remain elastic, or under the upper stress plateau, or remain plastic, but always under the breaking strain, of shape memory alloys at: room or environmental conditions; cooler than environmental conditions; and at a higher temperature, or

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body temperature. The methods described may also be applied to other industrial applications, where shape memory alloys may be installed and removed at different temperatures. Applications in other industries, include aerospace, civil structures, mechanical structures are contemplated.

CN116433185 - The invention discloses a civil engineering management method and system based on cloud computing. The method comprises the steps that a construction unit module arranges construction data and building design requirements and uploads the construction data and the building design requirements to a cloud task processing module; the task processing module issues a construction task to the construction unit module according to construction data and building design requirements submitted by the construction unit module; the construction unit module executes the construction task and uploads construction data to the cloud data module of the cloud in real time; the cloud data module receives the construction data and stores the construction data to the cloud backup data module and the local backup data module; and the supervision unit module supervises the construction unit module to execute the construction task through the task processing module. The technical scheme of the invention is closer to an actual operation scheme of engineering management in civil engineering, and operation and data storage backup are put into an internet cloud platform through a cloud computing technology, so that the equipment pressure of a local end is thoroughly released, and the requirement of data collection and arrangement on personnel is eliminated.

CN219343303 - The utility model discloses an included angle adjustable type assembled retaining wall, and relates to the field of civil engineering construction and construction safety protection. Comprising a prefabricated vertical plate and a prefabricated bottom plate, an arc-shaped rotating shaft fixing pin is arranged on the left side of the upper end of the prefabricated bottom plate and penetrates through the lower end of the prefabricated vertical plate, so that the prefabricated

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vertical plate and the prefabricated bottom plate are rotationally connected, and the right side of the upper end of the prefabricated bottom plate and the back face of the prefabricated vertical plate are adjustably limited through a supporting mechanism; the supporting mechanism comprises a plurality of prefabricated bottom plate clamping teeth arranged on the right side of the upper end of the prefabricated bottom plate and a plurality of prefabricated vertical plate clamping teeth arranged on the back face of the prefabricated vertical plate, the back face of the prefabricated vertical plate is connected with the right side of the upper end of the prefabricated bottom plate through a plurality of supporting plates, and the two ends of the supporting plates abut against the prefabricated vertical plate clamping teeth and the prefabricated bottom plate clamping teeth correspondingly. The patented technology has the advantages of being easy to mount and dismount, and more manpower and time can be consumed in large-scale, complex and changeable construction environments and temporary construction.

- CN116403234 - The invention discloses a CAD drawing-based construction engineering structure calculation amount automatic prediction method, and belongs to the field of engineering drawing image recognition. In order to solve the problem of long time consumption of manual calculation of engineering quantity, the method based on image recognition is constructed to automatically pick up component information and drawing content in a drawing; a natural language processing technology is utilized to realize extraction of tables and text contents in the drawing, so that the information processing efficiency is improved; through a machine learning technology, matching between reinforcement information and components is realized, finally, automation of the structural calculation amount is realized by using a pre-established calculation formula library, the project amount and an evaluation list are automatically generated in cooperation with a unit price database, and the prediction efficiency of the project calculation amount is improved. The method is suitable for the fields

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of civil construction, engineering installation and the like, the engineering quantity is automatically predicted through image recognition and machine learning technologies, and the engineering quantity prediction efficiency is improved.

The utility model according to patent CN218912358 relates to the field of civil engineering, in particular to a reinforcing device with strong applicability for civil engineering, which comprises a first reinforcing pipe, the top of the first reinforcing pipe is fixedly connected with an adjusting frame, the inner side wall of the adjusting frame is fixedly connected with an adjusting rod, and the outer wall of the adjusting rod is rotatably connected with a second reinforcing pipe. Through the arrangement of the first reinforcing pipe, the adjusting rod, the adjusting rod, the second reinforcing pipe, the first threaded groove, the second threaded groove and the threaded rod, the second reinforcing pipe can be rotated by separating the first threaded rod from the first threaded groove, and the threaded rod on the second limiting plate is in threaded connection with the second threaded groove; and a first reinforcing pipe and a second reinforcing pipe are made to be in an L shape, so that the reinforcing angle of the device can be adjusted, the practicability of the device is greatly improved, the use universality of the device is improved, and rapid development of the civil engineering technology is effectively promoted.

CN218758612 - The utility model belongs to the technical field of civil engineering technology, and particularly relates to a civil engineering building construction support which comprises a construction support body, the construction support body comprises a support base, a hydraulic cylinder, a telescopic column, an operation platform and a connection fixing plate, the hydraulic cylinder is installed in the center of the support base, and a notch is formed in the plate; the guide mechanism is fixedly connected with the construction support, the guide mechanism comprises a guide steel pipe and a buffer assembly, the guide steel pipe penetrates through the notch and is fixedly

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connected with the support base, the guide steel pipe is provided with a ball hole and a square hole, and the buffer assembly is installed in the ball hole and the square hole. The utility model solves the problems that the existing civil engineering building construction bracket shakes and is not stable enough in the ascending process of an operation platform due to lack of a guide mechanism in the ascending and descending process, and the use safety of the construction bracket is not guaranteed.

CN115852955 -The invention discloses a pre-stressed pipe pile planting construction technology, and relates to the technical field of civil engineering, the pre-stressed pipe pile planting construction technology comprises the following steps: S1, preparing slurry, and mixing concrete or mortar with water to form the slurry; s2, drilling and grouting are conducted, drilling is conducted on the ground to form pile holes, and grouting and stirring are conducted; s3, a front precast pile is implanted, specifically, the front precast pile is vertically implanted into the pile hole, and the front precast pile is tamped, so that the front precast pile is only exposed out of the pile hole by 800mm-1000mm; s4, positioning a rear precast pile, hoisting the rear precast pile, placing the rear precast pile on the front precast pile, and horizontally moving the rear precast pile, so that the rear precast pile is adjusted to be coaxial with the front precast pile; s5, a rear precast pile is locked, the rear precast pile is fixed to the end of the front precast pile, and a composite pile is formed; and S6, the rear precast pile is implanted, the end of the composite pile is tamped, so that the front precast pile enters the pile hole, and the steps S3, S4 and S5 are repeated till the composite pile is completely implanted into the pile hole. The precast pile butt joint device has the effect of improving the butt joint efficiency of the two precast piles.

CN218715429 - The utility model discloses an efficient damping type buckling-restrained brace for civil engineering, and relates to the technical field of civil engineering technology, the efficient damping type buckling-restrained brace

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specifically comprises a side sleeve plate, an inner core plate and an embedded plate, a fixing plate is horizontally fixed on the inner wall of the side sleeve plate, and two sets of reset structures A are arranged on the inner wall of the side sleeve plate; the two sets of reset structures A are located on the side, away from the inner core plate, of the fixing plate, a reset structure B is arranged on the fixing plate and located between the two sets of reset structures B, and an inner wall plate is fixed to the position, close to the inner core plate, of the side sleeve plate and movably connected to the surface of the inner core plate. By arranging a reset structure A and a reset structure B, the reset structure B can be extruded by the inner wall plate, so that counter-acting force is given to the inner core plate to help the inner core plate to reset, the damping effect of the inner core plate is further improved, by arranging a connecting structure, the length of a connecting groove is large, the inner core plate can be matched with an embedded plate, the high-precision requirement for the inner core plate is not needed, and the error-tolerant rate is increased; the inner core plate is convenient to install.

CN115707833 -The invention discloses a construction technology for civil engineering force-loading piles and foundation piles. The construction technology comprises the following steps that firstly, equipment needed for civil engineering force-loading pile and foundation pile construction is prepared; 2, preparation work is conducted, specifically, the ground of a construction site is cleaned, ground and underground obstacles and the like are mainly included, the construction site is flattened and compacted, positioning paying-off is conducted on the construction site, a power supply and water supply system is arranged, and equipment such as a pile driver is installed; and thirdly, according to the elevation designed on the construction site and the specification and size of the load pile and the foundation pile, construction is conducted according to the principle that the load pile and the foundation pile are firstly deep and then shallow, firstly large and then small and firstly long and then short, the construction site is flattened and

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compacted before construction, when a pile machine is installed, the levelness of the pile machine is guaranteed, the pile machine is operated in an accurate and appropriate mode, and the construction efficiency is improved. And vibration of the machine body in the construction process of the pile machine is reduced.

CN218323987 - The utility model discloses a civil engineering wall surface pay-off auxiliary device, and relates to the civil engineering technology field, the civil engineering wall surface pay-off auxiliary device comprises a base plate, the upper surface of the base plate is fixedly connected with an electric push rod, and the top end of the electric push rod is provided with a preformed groove 2. By arranging the bottom plate, the gradienter, the bolt, the electric push rod, the rotating plate and the second reserved groove, a constructor can conveniently adjust the position of the rotating plate according to the wall face, whether the rotating plate is kept horizontal with the wall face or not is judged through the gradienter, and the accuracy of the paying-off positioning result is guaranteed; through mutual cooperation of a connecting block, a laser range finder, a sliding block, a first sliding groove, a first reserved groove, a second sliding groove, a limiting groove, a cushion block, a concentric-square-shaped groove, a rectangular block, a spring, a sliding rod, a cylindrical sliding block, a limiting device and a third reserved groove, a constructor can flexibly adjust the position of the laser range finder according to site conditions; and the limiting device and the limiting groove can be used for limiting.

US2023028912 - The invention presents a mechanism for assessing student designs against learning outcomes from the Accreditation Board for Engineering and Technology. Changes in formulation of the learning outcomes can be simply accommodated by changing association between the learning outcomes and performance indicators, but keeping assessment rubrics the same.2. We present a plugin for automatically verifying engineering requirements formulated in the SysML system modeling language. The plugin employs a generic verification

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method consisting of check points systematically positioned along the function chain.3. Smart Modeling and Simulation is an automated system for creating simulation models, performing rapid simulations and interactively interpreting the results. It can account for complex multi-physics interactions not traditionally supported by commercial analysis software.4. We also present a system for efficient non-linear analysis of civil engineering structures, one accounting for complex interactions, and yet offering an intuitive interface based on a minimal set of assumptions.

CN115521128 - The invention discloses a civil engineering load-bearing column construction process which comprises the following materials in parts by weight: 7-11 parts of cement, 5-8 parts of coarse and fine aggregate, 14-21 parts of lime, 22-34 parts of desulfurized fly ash, 3-6 parts of fine grinding admixture, 1-3 parts of gypsum, 1-3 parts of retarder, 2-6 parts of air entraining and water reducing agent, 3-5 parts of expanding agent, 5-10 parts of fly ash, 5-10 parts of slag powder and 5-10 parts of waste asphalt. According to the method, industrial waste materials including coal ash, slag powder and waste asphalt are adopted as reinforcing materials of the bearing column and are mixed with concrete raw materials of the bearing column, and after the bearing column made of different industrial waste materials is formed, a detection mechanism of a bearing capacity detection machine is used at the bearing position of the bearing column to detect the bearing capacity of the bearing column. The bearing capacity detection machine is used for carrying out bearing capacity detection on the bearing columns added with the different reinforcing materials, and the bearing column with the maximum bearing acting force can be screened out by counting the bearing data of the bearing columns added with the different reinforcing materials.

CN218233776 - The utility model discloses a node structure of a full assembly type reinforced concrete frame, which relates to the technical field of civil engineering technology, comprises a prefabricated main beam, a prefabricated

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longitudinal beam and a prefabricated cross beam, ensures that concrete has a larger root size and prevents brittle fracture of the concrete no matter whether tenons or mortises are formed, and improves the construction efficiency. The inclined tenon-and-mortise joint surface enables the concrete contact area to be large, enough gaps are reserved in the connecting area at the joint, it can be ensured that concrete pouring is conducted smoothly, reliable bonding strength is achieved, concrete brittle failure is prevented, the tenon-and-mortise structure is matched with the reinforcing steel bars which are distributed in a staggered mode around and connected in a threaded mode, and the stability of the beam is ensured.

CN218214424 - The utility model discloses an environment-friendly prefabricated concrete structure reinforcement sleeve grouting connection technology training device, and relates to a device for technical training of civil engineering professional technical skill personnel or college students and the like. The sleeve grouting training device is mainly designed for solving the problems that an existing sleeve grouting training device consumes a large amount of water resources and the like. The device comprises a base, a groove is formed in the upper surface of the base, and a water collecting tank and an overflow tank are arranged in the base; a hole is formed in the position, corresponding to the water collecting tank, of the groove bottom of the groove. The upper parts of the water collecting tank and the overflow tank are connected with an overflow pipe which is internally provided with a water pump connected with a water pipe; the lower component is placed in the groove, the guide blocks at the left end and the right end of the upper component are matched with the guide rails at the left end and the right end of the lower component respectively, the elevator is installed on the cross beam, and a steel rope of the elevator is connected with the upper component. Each steel bar sleeve in the upper component corresponds to each steel bar of the lower component; a fixing frame is fixed to the lower surface of the upper

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component, and the sealing strip is installed on the fixing frame. The device has the advantage of saving water.

KR102477116 - The present invention relates to a method of manufacturing an eco-friendly concrete block using bottom ash and an eco-friendly concrete block manufactured by the method, and more specifically, provides technology for manufacturing civil engineering resources, especially aggregates for concrete block manufacturing, by recycling waste resources including bottom ash discharged from power plants, as circular resources. The concrete block manufactured by the method according to the present invention can secure maintenance as a concrete block for sidewalks and driveways and also required strength, the block absorbs moisture and discharges additional inflow water to ground surface during rainfall to effectively prevent depletion of groundwater, inundation and flooding, and the block evaporates moisture therefrom during heat waves to reduce urban heat island effect. In addition, bottom ash, which is currently discharged and mostly landfilled as a by-product from coal-fired power plants to cause environmental problems, is recycled into a civil engineering resource, especially an eco-friendly aggregate for concrete block manufacturing, and industrial by-products has expanded utility as high value-added materials to increase a recycling rate and is utilized as aggregates for manufacturing high-quality concrete blocks, thereby preventing environmental pollution caused by disposal of industrial by-products and improving eco-friendliness by reducing carbon emissions by reducing cement usage and improving carbon neutrality. The method for manufacturing the concrete block comprises: a first step of preparing bottom ash; a second step of forming a concrete composition; a third step of inserting the concrete composition into a mold and vibrating the same; and a fourth step of hardening, demolding, and curing the same.

CN115446973 - The invention relates to the technical field of civil engineering, in particular to a rapid construction mold for reinforced concrete. The mold

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comprises a multi-directional limiting component and a slotting rib, and the multi-directional limiting component is prefabricated by adopting an ultra-high performance concrete material and is integrally formed; the slotted ribs are prefabricated by adopting a fiber reinforced composite material; each limiting component comprises an upper wall plate, a left side wall, a right side wall and a lower wall plate, a plurality of concave areas which are symmetrical to one another and are of a toppling U-shaped structure are arranged on the left side wall and the right side wall of each limiting component, the number of the slotting ribs is the same as that of the concave areas, and the slotting ribs horizontally penetrate through the concave areas and penetrate through the front sides and the rear sides of the limiting components. Small-size standard assembly parts are adopted, the factory prefabrication technology is used for refined manufacturing, transportation and on-site rapid construction are facilitated, the multidirectional limiting components and the slotting ribs obtain a strong structure with small geometric size, light weight, high strength and good durability are achieved, holes in geometric shapes are formed in the components, the weight is reduced, and the construction efficiency is improved. And the connection with other prefabricated members can be realized.

CN217729117 - The utility model discloses a reinforced concrete prefabricated frame capable of being quickly separated in the later period, and relates to the field of civil engineering, the reinforced concrete prefabricated frame comprises a bottom plate, the bottom of the bottom plate is fixedly connected with two fixed plates I, two bearings I are clamped in the fixed plates I, and a screw rod is sleeved between the two opposite bearings I. The worm is rotated through the handle, the worm can drive the screw on the right side to rotate through cooperation with the worm gear, the two screws can be linked through cooperation of the two belt wheels and the belt, the screws can drive the two second baffles to be away from each other through cooperation of the two threaded sleeves and the two L-shaped

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plates, meanwhile, the winding wheel can be driven to rotate through the screws, and the winding wheel is driven to rotate. The rope is wound through the winding wheel, the two first baffles can be made to be away from each other, the first baffles are made to be separated from the concrete plate, the supporting plate and the concrete plate are driven by the electric push rod to move upwards, a certain gap is formed between the concrete plate and the bottom plate, and therefore the concrete plate is convenient to move, and the problems proposed in the background technology are effectively solved.

CN115122474 - The invention discloses a construction method for using a flexible thin-wall waterproof material as a plate hole core mold, and relates to the technical field of civil engineering construction, in particular to a construction method for using a flexible closed thin-wall waterproof material as a plate hole core mold of an assembled integral prefabricated through hole wall plate to achieve through hole forming and easy demolding of a prefabricated concrete through hole plate. A traditional fixed formwork and core mold production mode is low in production efficiency and large in resource consumption, and continuous production cannot be organized, so that a new technology for reserving vertical through holes in an assembled integral prefabricated through hole wallboard needs to be invented to solve the manufacturing problem. The method is used for assembling the integral prefabricated through hole wallboard.

CN217300599 - The utility model relates to the technical field of civil engineering, in particular to a primary support combined structure based on a novel four-limb main reinforcement grating steel frame, which comprises four main reinforcements which are arranged in parallel to form the grating steel frame with a rectangular cross section, and a V-shaped reinforcing rib is arranged between the two main reinforcements on the surrounding rock side and the clearance side. The four main reinforcements are provided with X-shaped connecting reinforcements along diagonal lines, the connecting reinforcements

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and the main reinforcements are in lap joint through hot melting, and the novel four-limb main reinforcement grating steel frame can be used as a framework to be matched with fine reinforcing meshes or plastic geogrids and the like to form a primary support combined structure and is used for supporting an arch-shaped small eccentric pressed tunnel. The primary support combined structure not only has good toughness and prevents concrete from cracking and chipping due to compression, but also has good tensile property due to the thick main reinforcements on the clearance side, and can prevent large eccentric tensile damage exceeding expectation. Meanwhile, the utility model also has the characteristics of saving materials, simplifying the processing technology, being convenient to process and improving the working efficiency, enhances the torsion resistance of the primary support structure, improves the structural strength of the primary support, and has the beneficial effects of saving the construction cost, reducing the cost and the like.

CN114892978 - The invention belongs to the field of civil engineering base formworks, and particularly relates to a civil engineering base formwork construction technology and a fixing device thereof. The technology specifically comprises the steps that S1, a mold for base formwork shaping is taken out, then side plates of the mold are placed on the ground in sequence, then all the side plates of the mold are vertically placed, and a space with the periphery sealed is defined by the middles of the side plates; s2, a plurality of side plates are fixed in a surrounding mode through a fixing device, after fixing is completed, concrete is poured into the mold from the top end of the mold to the center, and after the concrete is solidified, the fixing device and the side plates are dismantled, and a shaped concrete base mold can be obtained; by means of the arrangement, in the occasion that the mold is long, a traditional fixing device does not need to be manually used, the mold is fixed on the outer side of the mold at intervals, the fixing belt can be wound on the outer side of the mold layer by layer by directly

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using the driving vehicle, the stability of the mold is guaranteed, and meanwhile the operation process is simple and rapid.

CN114638104 - The invention provides a design method and application of pervious concrete, and belongs to the technical field of civil engineering. The method comprises the following steps: determining the water-binder ratio of the cementing material, the viscosity of slurry and the thickness of an aggregate wrapping layer according to the breaking strength of the cementing material; the pervious coefficient of the pervious concrete is designed based on the pervious coefficient of the aggregate, the pervious coefficient of the pervious concrete is obtained by combining the rich slurry amount and construction process correction, and the compressive strength of the pervious concrete is designed by using the breaking strength of the portland cement paste according to the stress damage characteristics of the pervious concrete. The compressive strength of the pervious concrete is corrected in combination with the slurry enrichment amount and the construction technology, and the use amount of the cementing material, the use amount of water and the use amount of aggregate are calculated in combination with the density of the aggregate and the density and viscosity of the cementing material slurry based on the equal-diameter aggregate accumulation principle.

CN216740675 - The utility model discloses a civil engineering concrete building template with a detachable structure, which relates to the field of civil engineering, and comprises a U-shaped plate I. The front side of the U-shaped plate I is fixedly connected with a fixed plate I, and the fixed plate I is respectively clamped with a sliding sleeve II and a threaded sleeve. A second screw rod is rotated through a second handle, the second screw rod is matched with a threaded sleeve, a second sliding sleeve and a sliding rod to drive a second fixing plate to move downwards, a rope is pulled through the second fixing plate to enable two first screw rods to be close to each other, and a baffle and an L-shaped baffle can be limited through two nuts respectively. By arranging the L-shaped baffle, the

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baffle and the first U-shaped plate, a rectangular cavity can be formed, the worm is rotated through the first handle, the worm can drive the supporting rod to swing through cooperation with the worm gear and the rotating shaft, the supporting rod makes contact with the ground, and therefore the stability of the baffle and the L-shaped baffle can be improved, and the device is convenient to operate, high in stability and high in practicability. The problems in the background technology are effectively solved.

CN114411764 - The invention discloses an intelligent optimization technology for high fill filling and a construction method thereof, and belongs to the field of civil engineering. For a fill project with the height larger than or equal to 50 m, the water content of filler is controlled to be close to the optimal water content, displacement positioning sensors are laid on the bottom face of the fill and the elevation plane where the filling height is increased by  $0.1 H$  every time, the displacement positioning sensors are arranged in a shape like a Chinese character 'mi', and the interval is  $0.05 L$  ( $H$  is the designed height of the fill, and  $L$  is the section perimeter of the corresponding elevation fill); sensor data are monitored in real time through a satellite positioning continuous operation reference station, the elevation range in which filler is compacted through the self weight of the fill without mechanical compaction treatment is determined, the quality, stability and safety of the fill are automatically monitored and evaluated in real time, the construction process is guided, the filling quality is controlled, and safety monitoring and disaster early warning of high fill operation are achieved. According to the intelligent optimization technology for high-fill filling and the construction method of the intelligent optimization technology, the problems that in a high-fill project, the filling compaction work amount is large, the compaction quality is not easy to control, and early warning is difficult to conduct on operation safety can be solved.

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CN214531209 - The utility model relates to a concrete crack grouting, repairing and reinforcing structure, and relates to the field of civil engineering technology, the concrete crack grouting, repairing and reinforcing structure comprises a repairing groove formed in the extending direction of a crack, the repairing groove is a trapezoidal groove, a water stop layer is arranged on the bottom wall of the repairing groove, a steel wire mesh is laid on the side wall of the repairing groove, and a reinforcing assembly used for reinforcing the steel wire mesh is arranged at the steel wire mesh. A frame layer is arranged at the end, away from the water stopping layer, of the steel wire mesh and internally provided with a filling layer. While the crack is repaired, the probability of leakage at the crack is reduced, the leakage position is further reinforced, and the shear resistance and tensile strength of the concrete crack are improved.

CN113445732 - The invention discloses a civil engineering slope panel structure, an erecting method and a civil engineering slope laying method. The civil engineering slope panel structure comprises a bottom formwork, binding steel bars and a steel wire mesh, the binding steel bars are arranged on the bottom formwork, and a plurality of fixing points are arranged; the steel wire mesh comprises two layers, namely a first-bound steel wire mesh and a second-bound steel wire mesh, the first-bound steel wire mesh and the second-bound steel wire mesh are distributed at intervals, and the second-bound steel wire mesh and the first-bound steel wire mesh are arranged in a lap joint mode. Double-layer steel wire meshes arranged at intervals are adopted to replace a traditional formwork, the first-bound steel wire meshes are firstly laid and bound, then pouring is conducted, the second-bound steel wire meshes are bound after pouring, then pouring is continued, a gap between the steel wire meshes is used for vibration of a vibration rod, pebbles and mortar permeate outwards from the steel wire meshes, and a protection layer is formed outside. A traditional slope plate construction technology is optimized, use of formwork materials can be effectively reduced in

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the construction process, so that the mechanical transfer pressure is relieved, the construction difficulty of workers is reduced, and the cost and the construction progress are optimized to a certain degree.

RU2751031 - FIELD: industrial and civil engineering. SUBSTANCE: invention relates to the field of industrial and civil engineering, namely to the technology of the device of ventilated cladding of buildings and structures, used both in the construction of new buildings and in the reconstruction of previously operated structures, to give them aesthetic qualities and increase the degree of thermal insulation and protection from external atmospheric influences with the possibility of implementing both horizontal and vertical cladding, as well as for the installation of the roof of buildings. The technical result is achieved by the fact that the linear panel facing set includes a linear panel containing a shelf with stiffening ribs on it and edges with bends, and a linear bar with a shelf and edges made of cold-bent metal galvanized profile, while the linear panel is made of OMEGA section, and the linear bar is made of U section, with the possibility of providing lock latching and fixing the linear bars when installing the linear sets on the facade to be faced, in the space between the two edges of the panels, formed by superimposing the bend of one panel on the bend of an adjacent panel. EFFECT: reduction of labor intensity both in the manufacture of a linear panel set, and in the process of installation works, the simplification of the connecting elements of a linear panel set, to possibility to replace individual panels when they are damaged without much labor while maintaining the marketable appearance of the facade surfaces, to be able to combine the texture and color of the surfaces of linear panels and slats to solve aesthetic problems when implementing facades.

LT2019040 - The invention relates to a method for cleaning gaseous pollutants, specifically for the sorption process by the waste incineration bottom ash, to reduce the concentration of carbon dioxide (CO<sub>2</sub>) in gaseous combustion

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products. The object of the invention is to provide a method for purifying (reducing) gaseous pollutants (CO<sub>2</sub>) during the combustion process, by using waste incineration bottom ash as an effective sorbent filler, which could be used in civil engineering after exploitation. This technology has two main advantages: carbon dioxide is removed from the gas; insoluble calcium carbonate (CaCO<sub>3</sub>) is formed during the carbonation reaction, when the reaction of calcium oxide (CaO), carbon dioxide (CO<sub>2</sub>) and water vapor (H<sub>2</sub>O) takes place. CaCO<sub>3</sub> acts as a binder during the bottom ash stabilization process, preventing heavy metals from leaching. Waste incineration bottom ash is used as a sorbent material; the concentration of calcium oxide (CaO) in bottom ash is not less than 20%; the particle size of bottom ash reaches 0-11.2 mm and humidity - 20%.

KR102030059 - 3D printer for manufacturing a test body (10) for physical property evaluation comprises: a nozzle head (100) including a nozzle (110) through which a sample (1) forming a test body (10) is discharged; a first driving unit (210) for vertically moving the nozzle head (100); a second driving unit (220) for horizontally moving the nozzle head (100); a third driving unit (230) for moving the nozzle head (100) in a forward and backward direction; and a supply unit (300) for supplying the sample (1) to the nozzle head (100). The nozzles (110) are formed in the nozzle head (100). According to the present invention, a concrete test body including a plurality of layers can be easily manufactured and physical properties of the concrete test body can be practically evaluated.

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